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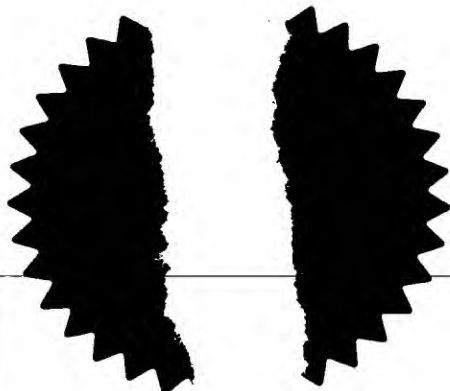


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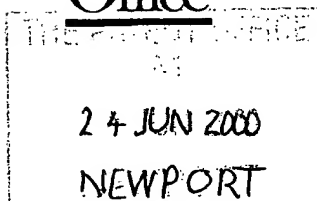


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SJW/7665

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3. Full name, address and postcode of the or of each applicant (underline all surnames)

Cerestar Holding B.V.  
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PO Box 9  
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Patents ADP number (if you know it) 7006240002

If the applicant is a corporate body, give the country/state of its incorporation

Holland

4. Title of the invention

"Agglomerated Starch-Based Product for Food Preparation"

5. Name of your agent (if you have one)

Stevens Hewlett & Perkins  
1 St. Augustine's Place  
Bristol BS1 4UD  
United Kingdom

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Patents ADP number (if you know it)

1545002 ✓

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Country

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Date of filing  
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

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- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is not named as an applicant, or
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# Patents Form 1/77

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Continuation sheets of this form

Description

10 ✓

Claim(s)

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Priority documents

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Statement of inventorship and right to grant of a patent (Patents Form 7/77)

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*Stevens Hewlett & Perkins*

Date

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## **Agglomerated starch-based product for food preparations**

### Technical field

The present invention relates to an agglomerated starch-based product based on starch and a hydrophilic compound, and dry mixes for food preparations containing the agglomerated starch-based product. When poured into a liquid, the agglomerated starch-based product disperses easily and develops its full viscosity instantaneously. Dry mixes comprising agglomerated starch-based product are particularly useful for preparing instant food preparations wherein the instant development of the viscosity is essential.

### Background of the invention

Instant mixes, containing fully pregelatinised starch, are increasingly popular due to their convenience. These instant mixes are dispersed in an aqueous fluid, such as cold water and milk, are agitated and are allowed to set for a certain time. Up to now emphasis has been put mainly on the improvement of the dispersibility of the instant mixes.

EP 0 517 423 relates to a dry hydrocolloid-containing composition that when hydrated readily disperses in cold aqueous fluids. The readily-dispersible hydrocolloid-containing food material is produced by spray-drying particles of the hydrocolloid with an aqueous solution of a wetting agent to agglomerate and spray-coat the particles. The wetting agent must be a water-soluble food-acceptable ingredient with little or no emulsifying capability and typical examples of such wetting agent are triacetin, glycerol, and tributyrin. The level of wetting agent which is applied to the surface of the materials being agglomerated is about 0.1% to 3% of the wetting agent by weight of the hydrocolloid material.

US 4,871,398 is directed to a continuous process for producing gelatinised, spray-dried and agglomerated starch which has a relatively narrow particle size distribution and a relatively low level of fine particles. The invention relates to a specially designed spray nozzle system which produces agglomerated pregelatinised, spray-dried starch without the need for separate agglomeration equipment. The thus produced starch material will typically contain agglomerates sized up to about 200 microns.

US 5,597,603 relates to a dry sugar-free instant pudding mix which is adapted for rehydration with skim milk or low-fat milk to produce sugar-free, no/low-fat puddings. The dry mix of this invention comprises agglomerated pregelatinised starch, and maltodextrin. The agglomerated, pregelatinised starch is the major component of the instant pudding mix. The aim of the invention is to provide sugar-free, fat-free instant pudding mix which upon hydration with skim milk produces puddings which exhibits setting and textural parameters comparable to those exhibited by instant puddings made with whole (fat-containing) milk.

US 4,156,020 relates to a process for producing a dry product for food preparations which readily and easily swell and dissolve in water or aqueous liquids without forming lumps. It is important that the water is first combined with the edible, hydrophilic substances, so that the starch is coated by the hydrophilic substances.

There exists a need for a thickening agent based on starch, which is incorporated in dry mixes for instant food preparations wherein the starch-based product is readily dispersible in water and the full viscosity of the thickener is developed instantaneously.

#### Summary of the invention

The present invention relates to an agglomerated starch-based product wherein at least 80% w/w of the discrete particles are greater than 100 microns and characterised in that each powder particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound. The present invention relates to an agglomerated starch-based product characterised in that the full viscosity of this product in cold milk is developed in less than 10 minutes, preferably in less than 8 minutes, more preferably in less than 5 minutes. The present invention further relates to an agglomerated starch-based product wherein the hydrophilic compound is selected from the group consisting of sugars, polyols, inorganic salts and mixtures thereof, and the sugars are selected from the group consisting of monosaccharides, disaccharides, glucose syrups, maltodextrin, and mixtures thereof.

The present invention further relates to an agglomerated starch-based product wherein the hydrophilic compound is present in an amount of between 5% w/w to 95%

w/w on dry base of the agglomerated starch-based product, preferably between 10% w/w to 75% w/w, and more preferably between 15% w/w to 50% w/w.

Particularly the present invention relates to an agglomerated starch-based product wherein the hydrophilic compound is a maltodextrin, which is present in an amount of between 15% w/w to 40% w/w on dry base of agglomerated starch-based product.

The current invention further describes dry mixes for making food preparations containing an agglomerated starch-based product wherein each particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound, and the hydrophilic compound is present in an amount of between 5% w/w to 95% w/w on dry base of the agglomerated starch-based product, and viscosity of said dry mix in cold milk is fully developed in less than 10 minutes.

The present invention relates to dry mixes containing the agglomerated starch-based product in an amount between 10% w/w to 100% w/w, preferably between 10% w/w to 95% w/w, more preferably between 10% w/w to 80% w/w on dry base. These dry mixes are applied in food compositions selected from the group consisting of instant bakery products, dairy products, instant sauces, soups, instant desserts and drink powders.

Furthermore the invention relates to a dry pudding mix comprising the agglomerated starch-based product between 20% w/w to 80% w/w, preferably between 40% w/w to 70% w/w, more preferably between 50% w/w to 60% w/w.

The agglomerated starch-based product can be produced by any known method for preparing agglomerated products, such as spray-cooking, roll-drying or agglomeration in fluid bed dryer, preferably by spray-cooking.

The spray-cooking process for preparing these starches is characterised in that the spray-drying tower inlet temperature, steam pressure and correct ratio of steam to starch slurry and powder of hydrophilic compound are selected for obtaining a homogeneous powder wherein each particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound.

### Brief description of the drawings

Figure 1 is a picture, taken with Wild Heerbrugg optical microscope (with magnification of 50x) of agglomerated starch-based product comprising 30% w/w maltodextrin DE 15. Stabilised light (Zeiss KL 1500 electronic) is used to enlighten the dry powder and the discrete particles with irregular shape are seen. The random distribution of the maltodextrin in the agglomerated starch-based product is clearly observed.

Figure 2 is a graph of the particular size distribution of agglomerated starch-based product comprising 30% maltodextrin DE 15. The particle size distribution is similar to the distribution of the starch product, while the maltodextrin product gives a different distribution. It is clearly seen that the particle size distribution of the agglomerated starch-based product is not just the sum of the curves from starch and maltodextrin.

Figure 3 is a graph showing the viscosity development of an instant pudding, comprising the agglomerated starch-based product comprising 30% maltodextrin DE 15, measured with a Brookfield viscosity analyser after setting time of 2, 5, 7, 12 and 15 minutes. Full viscosity is developed in less than 8 minutes. The profile is compared with the viscosity development of an instant pudding comprising a normal blend of pregelatinised starch and 30% maltodextrin DE 15. This pudding needs more than 10 minutes for development of the full viscosity.

### Detailed description of the invention

The present invention relates to an agglomerated starch-based product wherein at least 80% w/w of the discrete particles are greater than 100 microns and characterised in that each powder particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound. The powder characteristics are determined with a Wild Heerbrugg optical microscope. Dry powder is applied on the observation plate and enlightened with stabilised light (Zeiss KL 1500 electronic). With a magnification of 50x discrete particles with irregular shape and the random distribution of the maltodextrin in the agglomerated starch-based product are clearly observed (Figure 1). This random distribution of the maltodextrin in the agglomerated starch-based product permits the water to penetrate into the particles, resulting in ready dispersibility and quick development of the full viscosity. Moreover, the agglomerates have sufficient strength to



resist friction during the conveying and blending that is normally experienced by dry food mix ingredients.

Further powder characteristics are determined by the particle size distribution.

The present invention relates to an agglomerated starch-based product characterised in that its full viscosity in cold milk is developed in less than 10 minutes, preferably less than 8 minutes, more preferably less than 5 minutes. In fact, by applying the agglomerated starch-based product of the present invention the development of full viscosity needs 10% less time than the development of full viscosity of other starch-based products, preferably 20% less time, more preferably 30% time is gained. This gain of time is applicable in any dispersion medium. Normally, the development of viscosity is dependent on the medium wherein the agglomerated starch-based product is dispersed and it further depends on the temperature. The development of full viscosity of the agglomerated starch-based product in warm water (40°C) is instantaneously, and development of its viscosity in cold water only needs a few seconds. Cold milk is one of the more difficult media for developing full viscosity and this medium is used for the measurement of time needed to develop full viscosity, and it is used for the characterisation of the agglomerated starch-based product. The development of the full viscosity is measure with a Brookfield texture analyser.

The starch used in the present invention may be native starch from a variety of sources such as corn, waxy maize, potato, rice, wheat, cassava, sorghum starches, and/or modified starches, such as thin-boiled starches, oxidised starches, starch esters, starch ethers and/or mixtures thereof.

The hydrophilic compound is selected from the group consisting of sugars, polyols, inorganic salts and mixtures thereof. The sugars are selected from the group consisting of monosaccharides, disaccharides, glucose syrups, maltodextrin, and mixtures thereof. In the series of monosaccharides preferably glucose, mannose, galactose, fructose, tagatose, xylose, xylulose, ribose, ribulose, arabinose, erythrose, erythrulose or mixtures thereof are selected, while in the series of disaccharides preferably sucrose, maltose, isomaltose and/or lactose are applied. Glucose syrup is a blend of glucose, disaccharides and higher oligosaccharides, having a dextrose equivalent (DE) of more than 20. Maltodextrin is a glucose polymer with a dextrose equivalent (DE) of less than

20. The polyols are selected from the group consisting of sorbitol, mannitol, maltitol, isomalt, xylitol, arabinitol, ribitol, and erythritol and mixtures thereof. The inorganic salt is preferably sodium chloride.

The hydrophilic compound is present in an amount of between 5% w/w to 95% w/w on dry base of the agglomerated starch-based product, preferably between 10% w/w to 75% w/w, and more preferably between 15% w/w to 50% w/w. The higher the quantity of starch in the agglomerated starch-based product the more expressed the thickening properties of the agglomerated starch-based product. In case the hydrophilic compound is present in much higher levels than starch, the agglomerated starch-based product is readily dispersible but its thickening properties are not so expressed, due to the low level of starch present. Each combination of a typical starch product (native or modified) with a particular hydrophilic compound has an optimum weight ratio of starch to hydrophilic compound wherein the dispersibility and the development of the full viscosity of the agglomerated starch-based product are optimal.

The agglomerated starch-based product can be produced by any known method for preparing agglomerated starch, such as spray-cooking, roll-drying or agglomeration in fluid bed dryer, preferably by spray-cooking.

In case the agglomerated starch-based product is prepared by spray-cooking of unmodified (native) or modified starch and hydrophilic compound, an apparatus as is described in US 4,280,851, is applied.

An aqueous starch slurry is sprayed through an atomisation aperture in the nozzle, where the starch is gelatinised by being subjected to high temperature in the presence of moisture. On exiting the nozzle vent aperture, the resulting pregelatinised starch is in a finely sized atomised state. The hydrophilic compound is injected in the top of the tower in such a way that the trajectory of the dry powder crosses the spray pattern of the spray-cooked nozzle in order to produce agglomerated particles.

The agglomerated starch-based product is easily dried in the spray-drying tower and subsequently brought into an external fluid bed. The product from the fluid bed was sieved in a sifter and the oversized fraction was disrupted in a mill. The agglomeration and the particle size distribution of agglomerated starch-based product can be controlled by the nozzle configuration and by the application of a sifter and a suitable mill to screen

off and to mill an oversized fraction. The average particle size is closely related to the aperture of the top screen to be used in the sifter. The dried powder is recuperated in bags. The agglomerated starch-based product wherein at least 80% w/w of the discrete particles are bigger than 100 microns, is characterised in that each particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound. Its full viscosity develops, as it is measured in cold milk, in less than 10 minutes, preferably in less than 8 minutes, more preferably in less than 5 minutes.

Furthermore, the process parameters are correlated to

- a) the type of starch
- b) the type of hydrophilic compound
- c) weight ratio of starch to hydrophilic compound.

The process for preparing these agglomerated starch-based products is characterised in that the spray-drying tower inlet temperature, steam pressure, and the correct ratio of steam to starch slurry (weight steam/ weight starch slurry) is selected.

The weight ratio of steam to starch slurry is within the range of 0.1 to 3. The steam pressure is higher than 5 bar, and the tower inlet temperature is between 150°C and 250°C.

For preparing agglomerated starch-based product based on starch (C☆Tex<sup>R</sup> 06209) and 30% w/w maltodextrin DE 15 (C☆Pur<sup>R</sup> 01915), the weight ratio of steam to starch slurry is about 0.6 while the vapour pressure is about 10 bar at a steam flow rate of 370 kg per hour. The spray-drying tower had an inlet temperature of about 200 to 250°C and an outlet temperature of about 85 to 100°C.

The current invention further describes dry mixes for making food preparations containing an agglomerated starch-based product wherein each particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound, and the hydrophilic compound is present in an amount of between 5% w/w to 95% w/w on dry base of the agglomerated starch-based product, and viscosity of said dry mix in cold milk is fully developed in less than 10 minutes.

The invention further relates to dry mixes comprising the agglomerated starch-based product in an amount between 10% w/w and 100% w/w, preferably between 10%

w/w and 95% w/w, more preferably between 10% w/w to 80% w/w on dry base. These dry mixes are suitable for making food compositions which are selected from the group consisting of instant bakery products, dairy products, instant sauces, soups, instant desserts and drink powders. Particularly the dry mixes of the current invention are useful for any application wherein the rapid dispersibility and the rapid (= direct, instantaneously) development of full viscosity is an issue. Particularly the dry mixes of the current invention can be applied for any food composition comprising starch and maltodextrin.

The development of the full viscosity is measured with a Brookfield texture analyser. Full viscosity of an instant pudding comprising agglomerated starch-based product, which is comprising 30% w/w maltodextrin DE 15, is developed in less than 8 minutes. The viscosity of an instant pudding comprising a normal blend of pregelatinised starch and 30% w/w maltodextrin DE 15 is only developed in 11 minutes. The setting time needed for obtaining an acceptable viscous pudding having a smooth, creamy texture is decreased with at least 30%.

The current invention presents at least two main advantages. First of all the convenience is increased as it is more and more demanded by an increasing population. While up to now the preparation of instant food composition based on cold milk still need a significant setting time of more than 10 minutes, before the viscosity has been developed, applying the agglomerated starch-based product for preparing instant food compositions has significantly reduced this waiting or setting time. Less than 8 minutes are needed before viscosity of the corresponding food composition in cold milk is fully developed. In fact, the normal setting time and refrigeration of food preparations with instant mixes can be eliminated and after mixing the dry mix of the current invention with the aqueous liquid the finished product can directly be consumed. Secondly, the dry mix composition is simplified. The current invention provides two components, such as a starch-based product and a hydrophilic compound e.g. maltodextrin, in one agglomerated starch-based product, which is a homogeneous powder. Simplicity of the dry mix formulation improves convenience and moreover the risk of segregation during storage and transport is reduced to a minimum by using a homogeneous powder of agglomerated starch-based product.

The dry mixes based on agglomerated starch-based product give after adding a liquid such as water and/or milk, the finished products instantaneously in water or in less than 8 minutes in cold milk, and said products can directly be consumed and have a similar texture, appearance, and gel structure as compositions based on cooked starch.

Taste panels confirm that the instant puddings comprising the agglomerated starch-based product have smooth and creamy texture comparable with a stovetop cooked pudding.

The invention is illustrated by way of the following examples.

#### Example 1.

The agglomerated starch-based product was prepared by spray-cooking in a wide body spray-drier SF.

A starch (C☆Tex 06209) slurry containing 38% dry solids was pumped into the nozzle at a rate of 600 kg per hour at a temperature of 20°C.

Steam, as the heating medium at a pressure of 10.2 bar, was being pumped in the nozzle at an estimated flow rate of 371 kg per hour. The spray-drying tower had an inlet temperature of about 225°C and an outlet temperature of about 96°C, while the flow-rate of air was about 7900 kg per hour.

On exiting the nozzle vent aperture, the pregelatinised starch was in a finely sized atomised state. Dry maltodextrin DE 15 (C☆Pur 01915) (30% w/w of total agglomerated starch-based product) was injected in the top of the tower in such a way that the trajectory of the dry powder crossed the spray pattern of the spray-cooked nozzle for producing agglomerated starch-based product. The agglomerated particles were easily dried in the spray-drying tower and recuperated in an external fluid bed. The product coming from the fluid bed was sifted in a sifter of 600 microns and the oversize fraction was disrupted in a mill. The dried agglomerated starch-based product had a granulometry wherein at least 80% w/w of the discrete particles are bigger than 100 microns.

The product thus obtained has a macroscopic structure as can be seen in Figure 1.

The particle size distribution is seen in Figure 2.

### Example 2

The agglomerated starch-based product based on starch (C☆Tex 06209) and maltodextrin DE 15 (C☆Pur 01915) 70/30 w/w, prepared according to the process described in example 1 was applied in a pudding mix.

The pudding mix was prepared with the following ingredients (expressed as weight %):

Agglomerated starch-based product	60.0
Sucrose	40.0
Flavours and colours (Vanilla, cocoa...)	q.s.

The dry pudding mix was prepared by blending the ingredients. The pudding was prepared in glass bowls by adding 25 grams of the pudding mix to 200 ml of cold milk. Stirring was applied during addition of powder and continued for about 20 seconds. The bowl was stored at room temperature and viscosity has been evaluated after 2 minutes, 5 minutes, 7 minutes, 12 minutes and 15 minutes.

The viscosity development is shown in Figure 3.

## Claims

1. Agglomerated starch-based product wherein at least 80% w/w of the discrete particles are greater than 100 microns and characterised in that each powder particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound.
2. Agglomerated starch-based product according to claim 1 characterised in that its full viscosity in cold milk is developed in less than 10 minutes, preferably less than 8 minutes, more preferably less than 5 minutes.
3. Agglomerated starch-based product according to claim 1 or 2 characterised in that the hydrophilic compound is selected from the group consisting of sugars, polyols, inorganic salts and mixtures thereof.
4. Agglomerated starch-based product according to claim 3 characterised in that the sugars are selected from the group consisting of monosaccharides, disaccharides, glucose syrups, maltodextrin, and mixtures thereof.
5. Agglomerated starch-based product according to anyone of claims 1 to 4 characterised in that the hydrophilic compound is present in an amount of between 5% w/w to 95% w/w on dry base of the agglomerated starch-based product, preferably between 10% w/w to 75% w/w, and more preferably between 15% w/w to 50% w/w.
6. Agglomerated starch-based product according to claim 5 characterised in that maltodextrin is present in an amount of between 15% w/w to 40% w/w on dry base of agglomerated starch-based product.

7. Dry mixes for making food preparations characterised in that the dry mixes comprise an agglomerated starch-based product wherein each particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound, and the hydrophilic compound is present in an amount of between 5% w/w to 95% w/w on dry base of the agglomerated starch-based product, and viscosity of said dry mix in cold milk is fully developed in less than 10 minutes.
8. Dry mixes according to claim 7 characterised in that the dry mixes contain agglomerated starch-based product in an amount between 10% w/w and 100% w/w, preferably between 10% w/w to 95% w/w, more preferably between 10% w/w to 80% w/w on dry base.
9. Food compositions containing dry mixes according to claim 7 or 8 characterised in that the food compositions are selected from the group consisting of instant bakery products, dairy products, instant sauces, soups, instant desserts and drink powders.
10. A dry pudding mix containing a dry mix according to claim 7 or 8 comprising agglomerated starch-based product between 20% w/w to 80% w/w, preferably between 40% w/w to 80% w/w, more preferably between 50% w/w to 60% w/w.



Abstract

The present invention relates to agglomerated starch-based product and dry mixes based on agglomerated starch-based product which are suitable for preparing instant food preparations.

The agglomerated starch-based product is a homogeneous powder wherein each powder particle is an agglomeration of randomly distributed fine grains of starch and a hydrophilic compound. The agglomerated starch-based product develops readily dispersible in aqueous fluids and develops its full viscosity instantaneously.



Figure 1

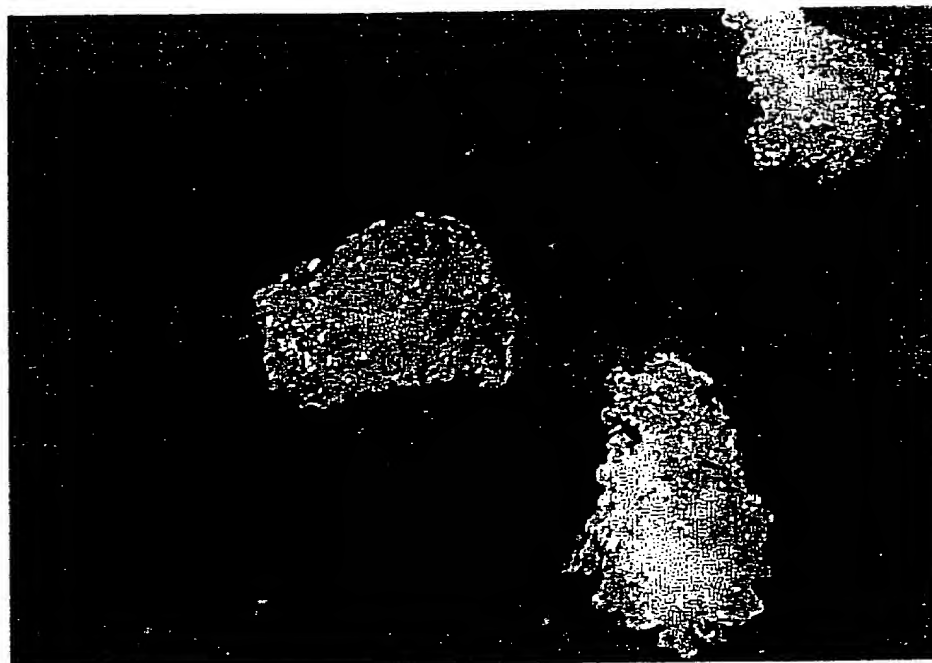




Figure 2

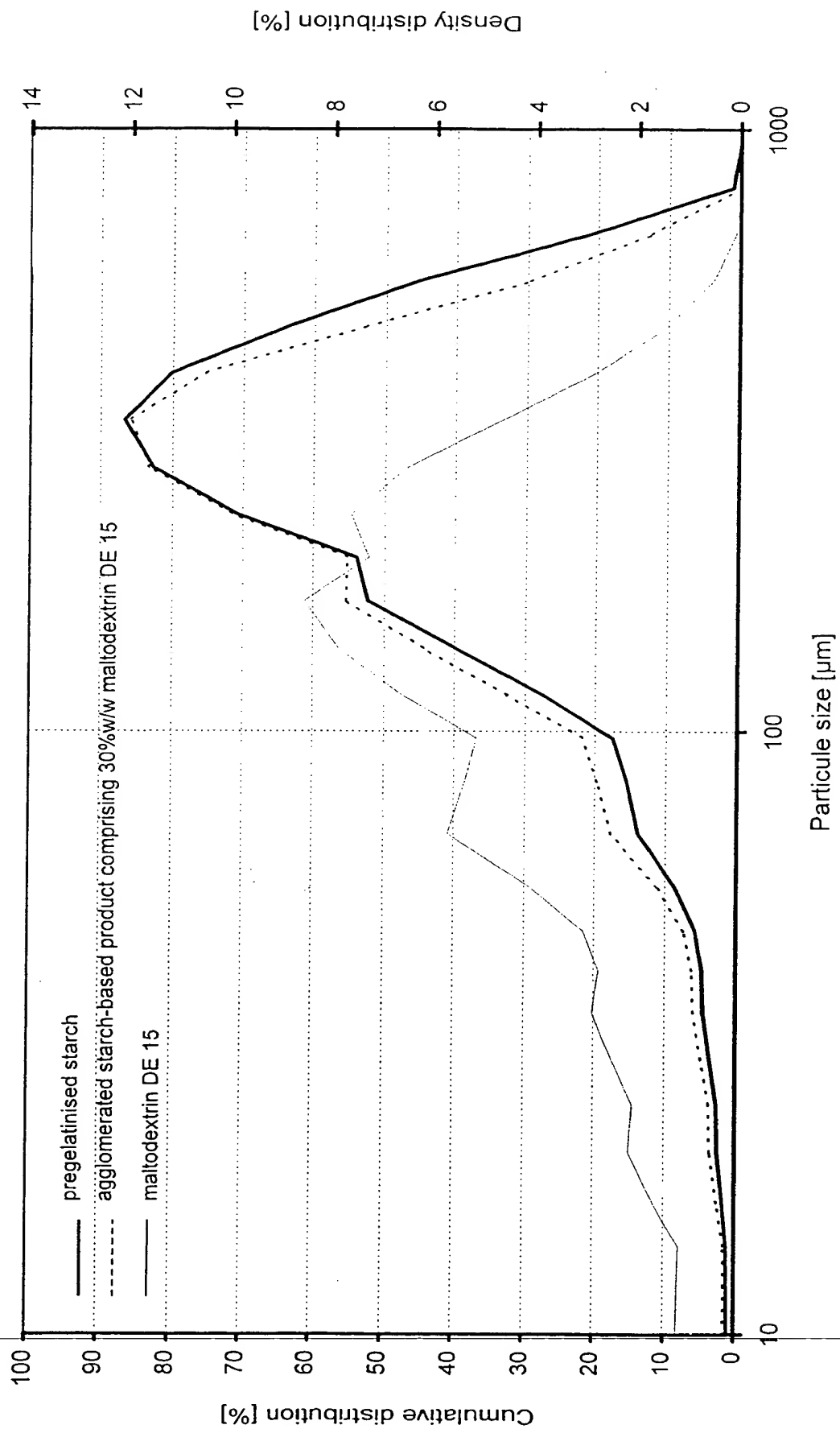




Figure 3

